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Using Hypermedia to enhance the teaching of language arts in the elementary grades

Dorlores Mae Epperheimer

USING HYPERMEDIA
TO ENHANCE THE TEACHING OF LANGUAGE ARTS
IN THE ELEMENTARY GRADES

A Project

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

In

Interdisciplinary Studies

By

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ACKNOWLEDGEMENTS

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INTRODUCTION

The information age is upon us, and we as a nation are concerned. Our long-held lead in technology has been overtaken by more dynamic foreign countries such as Japan and Germany. The tragedy of illiteracy has reached epidemic proportions in our country. We have been described as "a nation at risk" by the National Commission on Excellence in Education. We have begun to identify the "students at risk" in their early elementary school years, and it is their problem that I hope to address in this media project.

The term "at risk" applies to those students who can be identified at an early age as likely to be school drop-outs by the time they reach secondary school. These children show an early pattern of failure in communication skills, especially reading and writing. They seem to need help in organizing their thoughts and expressing them in written form. They also display a lack of motivation and appear to possess low self-esteem.

To meet the requirements of my Master's Degree in Interdisciplinary Studies, I have developed a multimedia project, "All About Me," which is designed to motivate and inspire students to write about themselves using a core hypermedia program to which they can add

text, graphics, sound, video, photography and laser disc images. Hypermedia can be defined as a system of linking this data in an associative, rather than linear, fashion. Proponents of hypermedia believe that it provides a more natural way of writing and that it corresponds to the way the human mind thinks (Parsaye, Chigness, Khoshafian, and Wong, 1989). These writers state that "the associative structure of the mind is very different from the linear way in which books and information are generally organized" (Parsaye et al., p. 224). A linear arrangement, such as a book or essay, represents a single path through a topic. In contrast, an associative structure allows many possible paths. Students can follow these paths to develop their own unique autobiography.

Hypermedia is still too new for research on its possible effects in the classroom, but my review of current journals will give some recent information and opinions on this subject. Research does show, however, that the processes of reading and writing are best taught together from a holistic (whole) text approach. There is also evidence that learning is best achieved through a multisensory approach. Furthermore, it has been shown that students write more willingly when they have empowerment to choose their own topics and can write from their own experience. My project incorporates all of these ideas in a writing program that is designed to be interdisciplinary and cross curricular.

In the following pages, I will review current research related to this project. I will also state the objectives of the project and describe it in detail, including sample pages of the screens. For my conclusion, I will describe my use of the project in a remedial reading center, including any successes and/or limitations; and I will discuss the implications for future use.

REVIEW OF THE LITERATURE

The purpose of this review is to determine if research supports the use of a hypermedia database, such as "All About Me," to enhance and improve the language skills of "at risk" elementary school students. This refers to those students considered to be extremely likely to be future school "drop-outs. Hypermedia, or interactive multimedia as it is sometimes called, is new and still emerging in education, and as such, it still needs to be defined. The concept of multimedia is not new; any combination of media, such as lecture notes, slide projector, overheads, film projector and tape recorder, could be called "multimedia." However, as used today, the term "multimedia" has taken on a new significance. It now refers to the "integration of text, audio, graphics, animation, still image and moving pictures into a single computer-controlled multimedia product" (McCarthy, 1989, p. 26). What distinguishes the new "multimedia" from the old one is interactivity, which allows the user to navigate through the data in a non-linear direction. This is made possible by a computer environment called "hypertext," a term coined by its developer Theodor Nelson in the early 1960s.

While studying philosophy and sociology at Harvard, Nelson envisioned an electronic system that would link the material he was learning in the two disciplines. Nelson described it as "...non-sequential

writing, text that branches and allows choices to the reader, best read at an interactive screen" (Paske, 1990, p. 54). This interactive database allowed the user to branch from one topic to another from within available documents. With early computers, the display was limited to text. Today's technology allows the combination of text with other media, such as graphics, animation, sound, music, video, film, laser disc images, and CD-ROM, all with the interactivity of hypertext, thus the term "hypermedia." The "hyper" part of the term means "over" or "beyond"; the word "media" means "channel of communication." Together they denote a "system of audio-visual and textual communication that allows users to interactively navigate through a multimedia information base using their intuition, memory, and interest as a guide" (Paske, p. 54).

According to current conceptions of learning based on cognitive psychology, learning is a reorganization of knowledge structures. Knowledge structures refer to the organization of ideas in semantic memory (Jonassen, 1988). These ideas, or schema, are made up of a series of attributes that individuals form from their own experience. These schema are arranged, as Jonassen stated, "in a network of interrelated concepts known as a semantic network" (Jonassen, p. 13). These networks represent our knowledge structures and are linked together by the interconnections of associations; as an example, our schema for dog is comprised of attributes such as fur, four-legged, tail, to name a few. These

schema are interconnected to our larger concept of animal. Thus, according to Jonassen, learning consists of building new structures by constructing new schema and forming new links. These links, or interconnections, are formed between existing knowledge and new knowledge. He conceived of learning as a reorganization of cognitive structure, and he claimed that the more links that can be formed between existing knowledge and new knowledge, the easier learning will be. As such, he found that "tools are needed for depicting and displaying appropriate knowledge structures, as well as means for mapping that structure onto the learner's knowledge structure. Computer environments are emerging that are capable of doing that. The most promising of these is hypertext" (Jonassen, p. 13).

This form of interactive information access is the basis of the personal database, "All About Me." I have designed it for upper elementary students using a hypertext authoring program called HyperStudio. With this application, students will be able to choose their own way to navigate through the program, suited to their individual needs and taste. They will be able to select topics of interest to themselves about which to write, in whatever order they choose, and link these together in many flexible ways, choosing non-linear, associative paths. Parsaye et al. (1989) noted that the human mind seems to be inherently associative in nature. They based this observation on the interconnected

structure of the brain itself as well as the patterns of associative thinking that are evident in human behavior. Further, they indicated that "the associative structure of the mind is very different from the linear way in which books and information are generally organized" (Parsaye et al., 1989, p. 224). A linear arrangement, such as a book or essay, represents a single path through a topic. In contrast, an associative structure allows many possible paths. Students can follow these paths to develop their own unique autobiography.

In addition, students will be able to enhance their writing with various fonts, color, graphics, sound, music and even video images. Rickelman and Henk (1990) observed that, with hypermedia, learning becomes three dimensional rather than two dimensional. Putting all of this power into the hands of young students, especially those who are considered "at risk," gives them a sense of worth that increases their self-esteem. Howie (1989) claimed that students, who are given choices, feel in control of their own learning and are likely to have greater self-confidence and be better motivated. They seem to become "pro-active learners instead of passive receptors" (McCarthy, 1989, p. 30). The computer becomes, not something that controls them, but a powerful technological tool that is readily accessible to them. "Hypermedia is another step away from systems for the computer intelligentsia and toward systems that better accommodate how most people think" (Corcoran, 1989, p. 72).

In addition to the empowerment that hypermedia gives to the student, there is the benefit of its appeal to multiple learning styles. Vandergrift (1988) observed that every user comes to a hypermedia program with his or her own interest level and learning style, not only in relation to media (i.e. sound, pictures, text), but also in preferences between inductive and deductive approaches. The student is allowed to set up a unique learning situation that depends on his prior knowledge, confidence and learning mode. Students are allowed to participate according to modality strengths. Marcus (1990) states that educators have long recognized the value of trying to reach students through a variety of sense modalities. Both auditory and visual learners will be stimulated to creativity, and the two modalities can enrich and reinforce each other. A student, in writing about his place of birth, could add a drawing of it, a scanned photograph, a map, an animation following the route from there to his present home, a recording of a state song, and a video image from a laser disc.

At this point, one question that might be asked is how can hypermedia, exciting as it may be, improve the writing and reading skills of elementary students? The whole language or holistic movement in teaching sets forth the view, stated by Kenneth Goodman, that "you learn to read and write while you read and write to learn." He emphasizes the importance of creating opportunities for pupils to use language in

"authentic, richly contextualized, functional ways" (Goodman, Goodman and Hood, 1989, p. xi). Rhodes and Dudley-Marling (1988) state that young children learn language by using language and that they are most likely to focus that language on people, objects and events actually present in their lives. Proponents of whole language advocate that children write from their own experience about real events and experiences in their lives. Donald Graves believed that students' best writing comes out of their own experience. He claimed that, in general, students should choose their own topics for writing. Those who select their own topics not only "learn how to choose writing topics independently, but when they select topics well they also achieve significant growth in the information they present about topics, in the organization of information, and in the use of conventions" (Graves, 1983, p. 88). Graves also believes that children need to see the sense and purpose in what they are doing. This sense and purpose is what he calls "voice." He writes, "Children need to write every day and receive a response to their voices, to know what comes through so that they might anticipate self-satisfaction and the vision of the imprint of their information on classmates or the vision of their work in published form" (Graves, 1983, p. 160). What better vision than seeing their work in a computer program, complete with graphics, color and sound?

Howie (1989) also emphasized the relationship between reading and writing, stating that teaching the process of writing also teaches the process

of reading, and "to compose is to comprehend" (p. 6). She recommended that students be given the opportunity to write in every class and that reading and writing be taught as one process, from a holistic approach. She further said that when both reading and writing are taught together, there is improvement in both areas. And finally, she suggested that the computer is preferable to paper and pencil as a tool for practicing writing. It was her opinion that "the computer focuses attention more, is more motivating, is more easily corrected or changed, and tends to expand the attention span of the composer" (p. 23).

Hypermedia is still too new to have generated any research involving its value in classroom use. Rockland (1989) claimed that Multimedia is difficult to define precisely for purposes of research, and that it is new enough, and changing rapidly enough that little research has been focused directly on its impact in the classroom. Dede (1990) wrote of a need for funding a critical mass of researchers and teachers to design and develop instructional applications based on emerging technologies such as hypermedia. He found that current attempts to estimate the effects of technology on education "usually measure the consequences of poor adoption strategies instead" (Dede, p. 8) Bracey (1991) discussed the lack of valid research evidence on the impact of computers on children's learning. He conducted his own study, but the results showed only insignificant differences between computer using students and those

without computers. However, most of the computers classes in his study were using drill-and-practice programs and not applications such as word-processing. In earlier studies, Bracey (1988) concluded that out-of-date software, as well as primitive hardware, was used and, in most cases, results were inconclusive.

There is some recent research that seems to indicate that word-processing with computers does aid in writing instruction. Robinson-Staveley and Cooper (1990) compared the quality of writing of students using computers to that of students using paper and pencil. The results of their study indicated that essays written on the computer were significantly better than those written with paper and pencil, as measured by performance scores and grades given by instructors. They were also judged superior by data from a software tool that determined readability, spelling, punctuation and grammatical errors, number of words, average word and sentence length, and number of simple, complex, and compound sentences. The researchers gave, as probable reasons for these effects, the ease of revision and correction as well as the suggestion that the computer makes the process easier and more rewarding. If this can be said about a computer, it can most emphatically be said about hypermedia, which has all the positive characteristics of a word processing program with the added bonus of sound, graphics and video, not to mention the flexibility of interactivity.

In a Newsweek article, Rogers (1988) predicted that hypermedia will transform education as profoundly as television transformed entertainment. He quoted Stephen Arnold of Lucasfilm as saying that "the intensity of what you see and hear in hypermedia comes close to what you get in a film, only you can interact with it. It's a new kind of imaginary playground for the mind" (p. 44). The implications of the effect this media will have on students in respect to motivation are obvious. Heretofore reluctant readers and writers will be eager to try their hand at a hypermedia project. D'Ignazio (1989-90) compared multimedia to Lewis Carroll's Alice looking through the looking glass. Students will "dive into this multimedia looking glass" (p. 26) with all the eagerness and curiosity of a modern day Alice.

THE PROJECT: OBJECTIVES AND DESIGN

This project is a multimedia program for the computer, using a hypertext authoring tool, in this case, HyperStudio. It consists of a series of screens, called cards, to which a student can add text, graphics, animation, sound effects, spoken language, music, or video. Symbols, called icons, can be designed or imported by the student and made into "hot spots" called buttons, that, when clicked on with the computer mouse, will perform various functions. They may link the user to another card (i.e. screen image), play music or other sounds, ask questions, activate an animation, or elicit a video sequence. Besides buttons, there are also other tools with which to work. The student can use a text editor or a graphics text tool to type directly on the program in a variety of fonts, styles and colors. Original art work can be created with the paint and drawing tools, or graphics can be imported from clip art collections. Video images can be frozen, digitized and subsequently used in the program, as well as scanned photographs and other illustrations.

The cards can be linked in a variety of ways, taking full advantage of the power of hypertext, which allows the user to journey from idea to idea, somewhat as the mind wanders from thought to thought. This series of linked cards form what is called a stack. This project is a HyperStudio stack called "All About Me," in which students will be able to produce

their own unique, electronic autobiography. I have developed this project for use in a remedial reading center, but it is appropriate for any upper elementary classroom. The objectives are as follows:

1. Students will demonstrate increased ability in the area of written communication by the creation of an autobiographical stack in a HyperStudio program - "All About Me."
2. Students will read each other's stacks with increased comprehension and give oral reports on the background and interests of other students in the class.
3. Students will show evidence of increased self-esteem as demonstrated by active and successful participation in the project.
4. Students will subsequently create their own HyperStudio stacks in the form of reports on topics in science, social studies, literature or other areas of the curriculum.
5. Students will increase their reading skills, especially in the area of comprehension, by reading to research their stacks.
6. Students will read autobiographies and biographies as a result of the creation of their own autobiographies.

I have included the program on a 3.5 diskette for the Apple IIGS and a selection of printouts of sample screens. These can be found in the Appendix beginning on page 20. "All About Me" begins with

a title screen and a button linked to the next card, as well as a button connected to a description of the author (see Appendix, p. 21). The second card has a scrolling text screen in the center with the following inscription:

> We want to know all about you...what you like to do, what you like to play, what you like to eat, your favorite books and the games you like best.
>
> When you go to the next card, you will see a place where you can write a short autobiography about where you were born, how old you are, what your family is like, where you live and other interesting facts about yourself.
>
> After that, you may click on one of several buttons that will take you to a card where you could write about your favorite sports or one where you could tell about your hobbies, or describe your travels, or favorite foods, books or movies.
>
> You may write about as many of these topics as you want, or create cards for new ones, and you can write as much as you feel like writing. It will be fun for everyone to browse through this program reading ALL ABOUT YOU.

This text is surrounded with graphics of faces of boys and girls, and a button to go to the next card (see Appendix, p. 22).

The third card has a heading "All About _____," where the student can fill in his or her name. Below that is a scrolling text screen in which can be written an autobiography of whatever length the student desires. Surrounding this are a series of icons which can be activated to link with other cards (see Appendix, p. 23). One button has written on it, "Click here to see and hear me." The student can create a button that will play his or her voice greeting the user of the stack. This can be recorded live with a microphone and sound digitizer that comes with the program.

When the button is activated, it can be linked to another card where a digitized image of the student can be imported. This image can be placed anywhere on the card and bordered and captioned (see Appendix, p. 24 & 25).

The other icons that surround the text window can be selected from a large collection of clip art or drawn with paint and drawing tools. They can be symbols of sports or hobbies, games, music, television, books, food, travel, pets, family, friends, or whatever the young author wants to include in his or her autobiography (see Appendix, p. 23). As an example, a symbol of a radio could be linked to a card where the student could write about favorite musical artists or songs. Buttons in the form of records or tapes could be activated to play excerpts of favorite songs (see Appendix, p. 26). On the card about sports, a student could link to other cards with diagrams of football plays or scanned pictures of actual players.

Another button could be in the form of a world globe. A click on it could connect to a card where the author could describe his or her travels (see Appendix, p. 27). The icons surrounding this could lead to further details of places visited. Pictures or video images from a laser disc could be scanned in. One button could lead to a map of the United States, Europe or whatever area the student needed. The student could indicate his or her journeys on the map using the paint tools . (see Appendix, p. 28).

The possibilities are endless. If the student wrote about favorite movies, brief scenes could be incorporated. If favorite books were the choice, illustrations could be scanned in. When writing about hobbies, laser disc images could be included. It would even be possible, with the use of the Video Overlay Card, to display an image on the computer and combine it with graphics. Thus the student could, for instance, write about baseball and show a video of a batter's swing with graphics detailing the stance and form.

I am using this program in my computer lab, with fourth and fifth grade students who are reading below grade level. The HyperStudio program runs on the Apple IIGS with 1.25 megabytes of memory. Although the lab has eighteen computers, only five are equipped with enough memory to run the program. In order to digitize video for inclusion in the stacks, we use an AST Vision Digitizer in conjunction with a CamCorder. We have an Apple Video Overlay Card in one computer connected to a laser disc player. This group of students comes into the lab for one hour a day. The "All About Me" project is only one activity of many in which we are involved, but it is a favorite one.

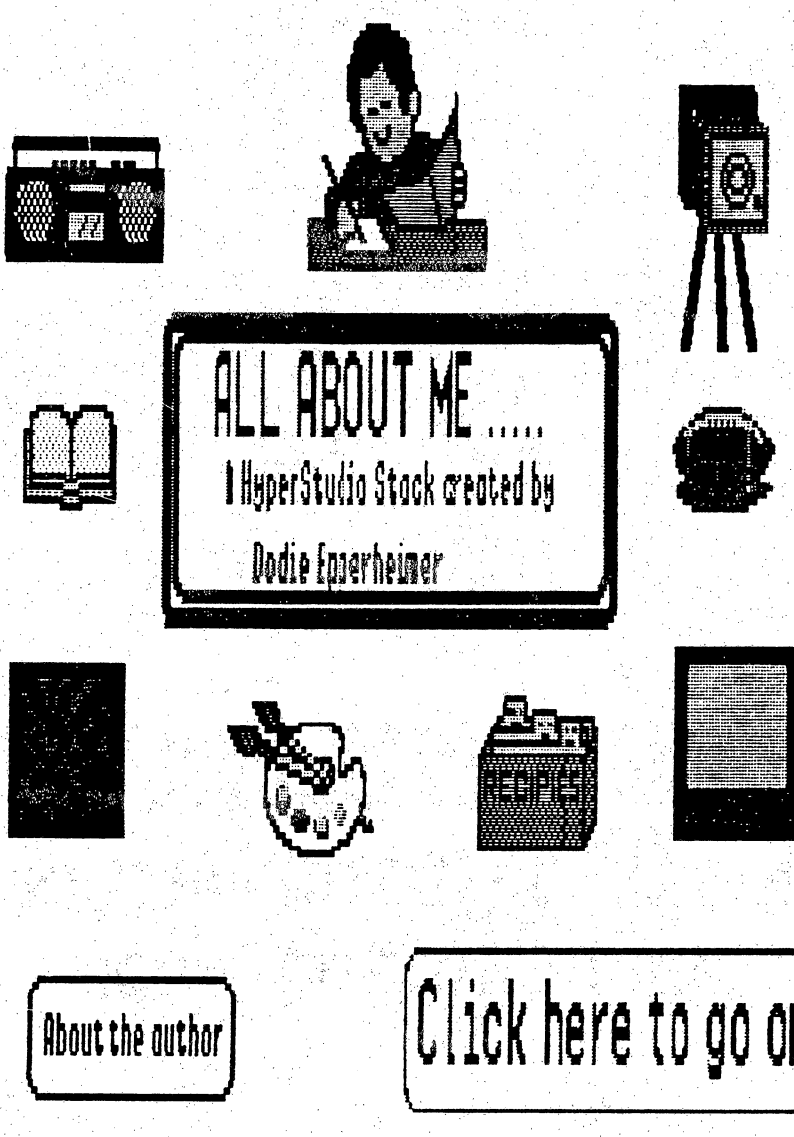
CONCLUSION

After using All About Me with fourth and fifth graders for several months, I am more convinced than ever about the power of hypermedia in motivating students to get involved in the writing process. They have been writing more frequently and of their own volition, often preferring the writing activity to any other offered. They have been more willing to read over what they have written, check for errors and misspellings, edit and rewrite. They have exhibited pride in their work and have been eager to share it with others. Much of this can be attributed to computer word-processing in general, but some of the excitement is due to hypermedia. As they learned to create their own buttons on the screens, they began developing their own unique stacks. They have decorated their stacks with graphics and different styles and colors of text and have personalized their own digitized photographs with recorded messages of greeting. Although none of them have Apple IIgs computers at home, they all plan to bring a blank 3.5 diskette to school at the end of the year to copy their stacks. This project was designed for my fourth and fifth grade students, but I have also written a simple "fairy tale" stack for the third grade students in my center, and the results are the same with these younger children.

There have been some drawbacks to the project. The HyperStudio program runs slowly unless it is on a hard drive, a luxury most classrooms cannot afford. I am fortunate to have a forty megabyte hard drive on one of my Apple IIGS computers, but when I want to have more than one student working on the program at a time, those on the computers with floppy disk drives are at a definite disadvantage. The program is slow and sometimes hangs up, causing some frustration. Despite these problems, the students all are eager to work on their writing projects using hypermedia.

I am not certain that the objectives set for this project have been met, but students did demonstrate increased ability in written communication, did read each other's stacks with comprehension, and showed evidence of higher self-esteem. The last three objectives will take more time to assess. I am not able to tell whether these students will go on to create more hypermedia projects, or whether they will read more biographies and autobiographies as a result of this project. The Burns-Roe Informal Reading Inventory shows that their reading comprehension has increased by at least a grade level. These students are "at risk"-- at risk to drop out of school, at risk to be near-illiterates in a society that demands the best from its citizens. Anything that can generate such enthusiastic participation from them has to be called a success.

APPENDIX


ALL ABOUT ME.....
A HyperStudio Stack created by
Dodie Epperheimer
About the author
Click here to go on....

ALL ABOUT ME...

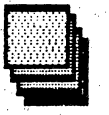
We want to know all about you...what you like to do, what you like to play, what you like to eat, your favorite music, television show, and movie, the books and games you like the best.

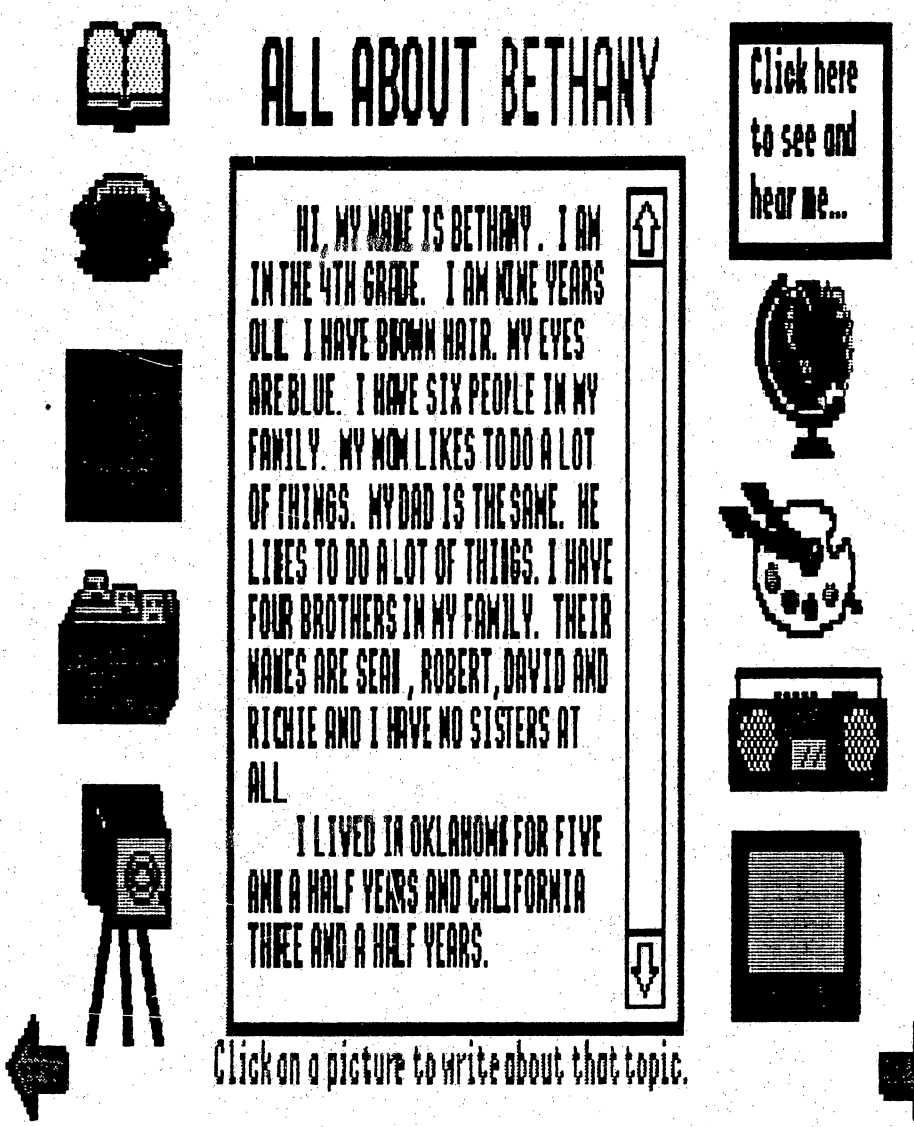
When you go to the next card, you will see a place where you can write a short autobiography, telling about where you were born, how old you are, what your family is like, where you live, and other interesting things about yourself.

After that, you may click on one of several buttons that will take you to a card where you could write about your

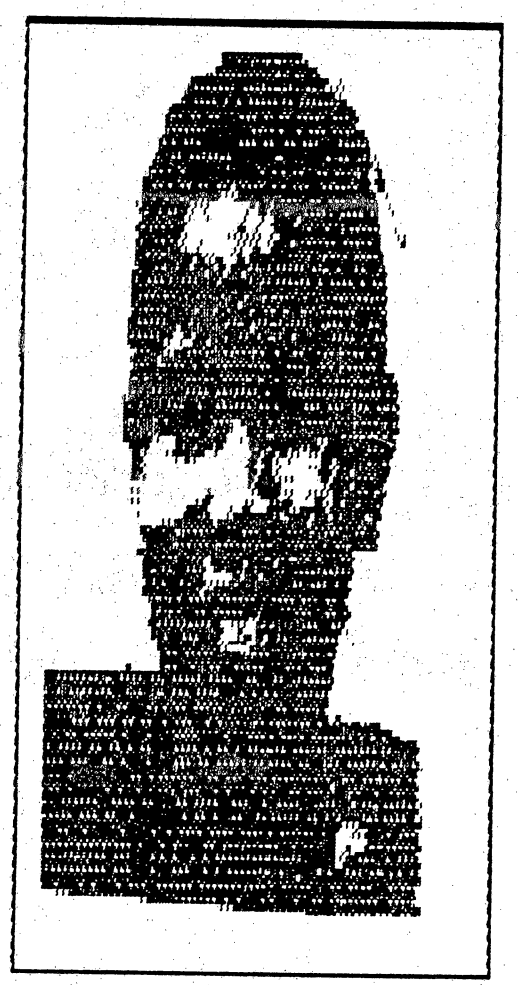
Click here to go back

Click here to go on

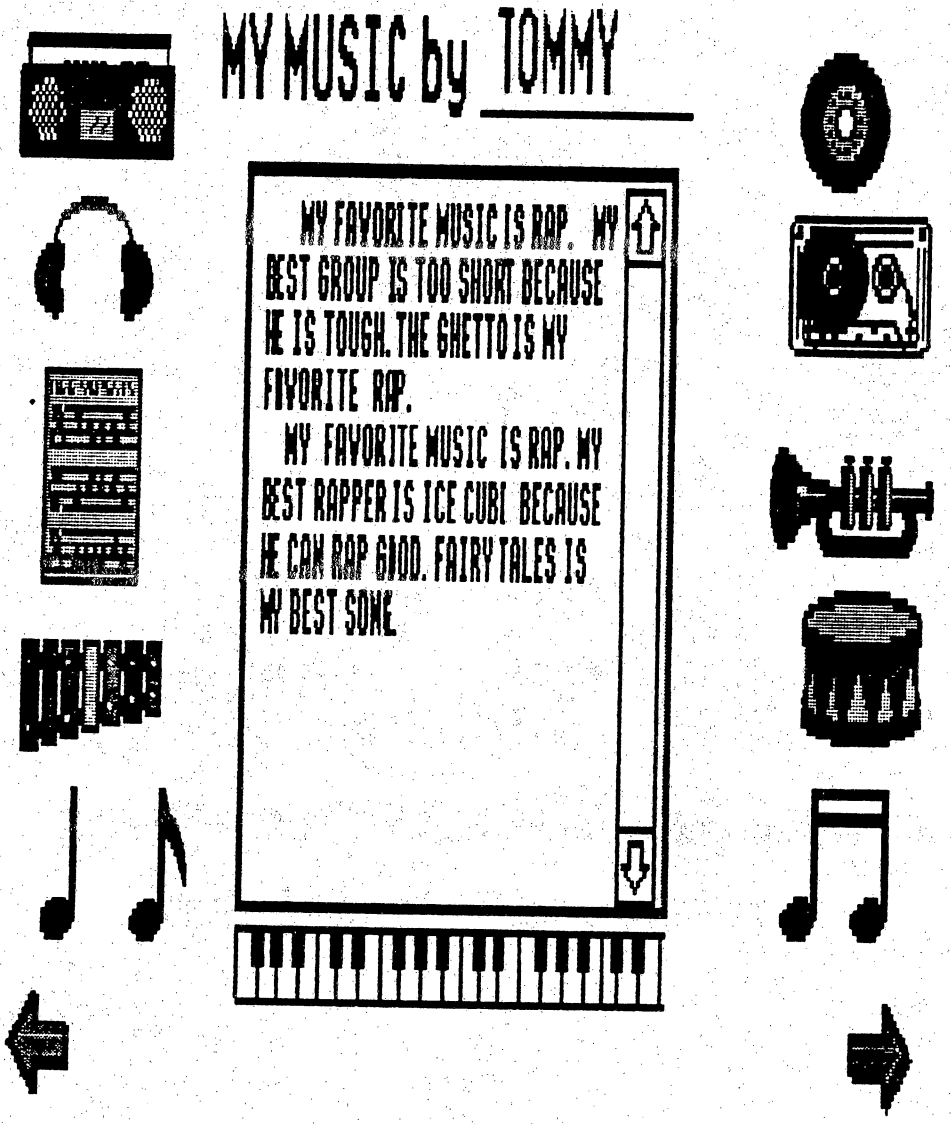



ALL ABOUT BETHANY
Click here to see and hear me...
HI, MY NAME IS BETHANY. I AM IN THE 4TH GRADE. I AM NINE YEARS OLD. I HAVE BROWN HAIR. MY EYES ARE BLUE. I HAVE SIX PEOPLE IN MY FAMILY. MY MOM LIKES TO DO A LOT OF THINGS. MY DAD IS THE SAME. HE LIKES TO DO A LOT OF THINGS. I HAVE FOUR BROTHERS IN MY FAMILY. THEIR NAMES ARE SEAN, ROBERT, DAVID AND RICHIE AND I HAVE NO SISTERS AT ALL.
I LIVED IN OKLAHOMA FOR FIVE AND A HALF YEARS AND CALIFORNIA THREE AND A HALF YEARS.
Click on a picture to write about that topic.

GO BACK

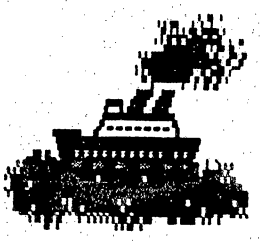


Alfred


MY MUSIC by TOMMY
MY FAVORITE MUSIC IS RAP. MY BEST GROUP IS TOO SHORT BECAUSE HE IS TOUGH. THE GHETTO IS MY FIVORITE RAP.
MY FAVORITE MUSIC IS RAP. MY BEST RAPPER IS ICE CUBE BECAUSE HE CAN RAP GOOD. FAIRY TALES IS MY BEST SONG.

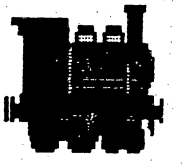
MY TRAVELS by Lakeisha

Click to see it spin



The farthest place I have gone is to Chicago to see my Grandma. I also been to Texas. We flew there in a plane. We go every year to see my aunt in San Jose. One time we went to Las Vegas and we drove there. We went through Arizona and New Mexico.

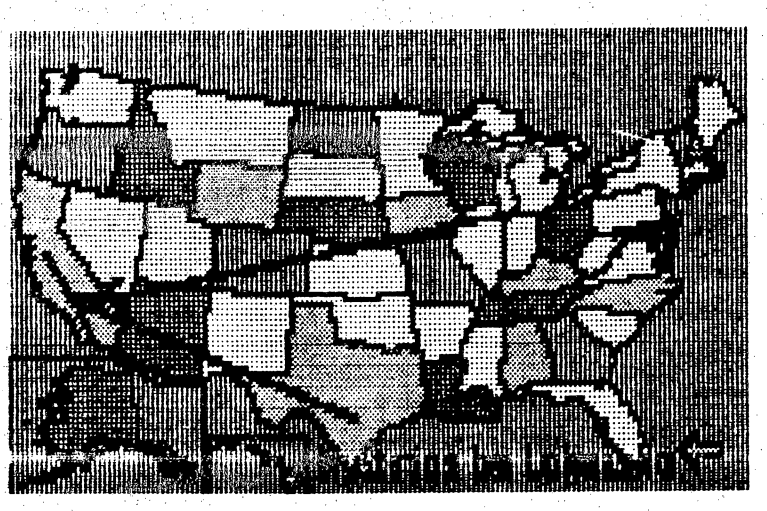
We have gone lots of times to Los Angeles and San Diego. But where I want to go is Hawaii.

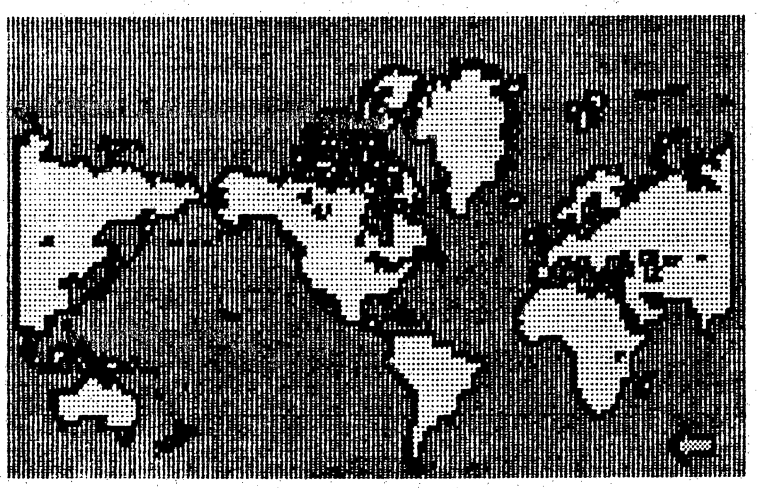


Click on maps to see my travels...

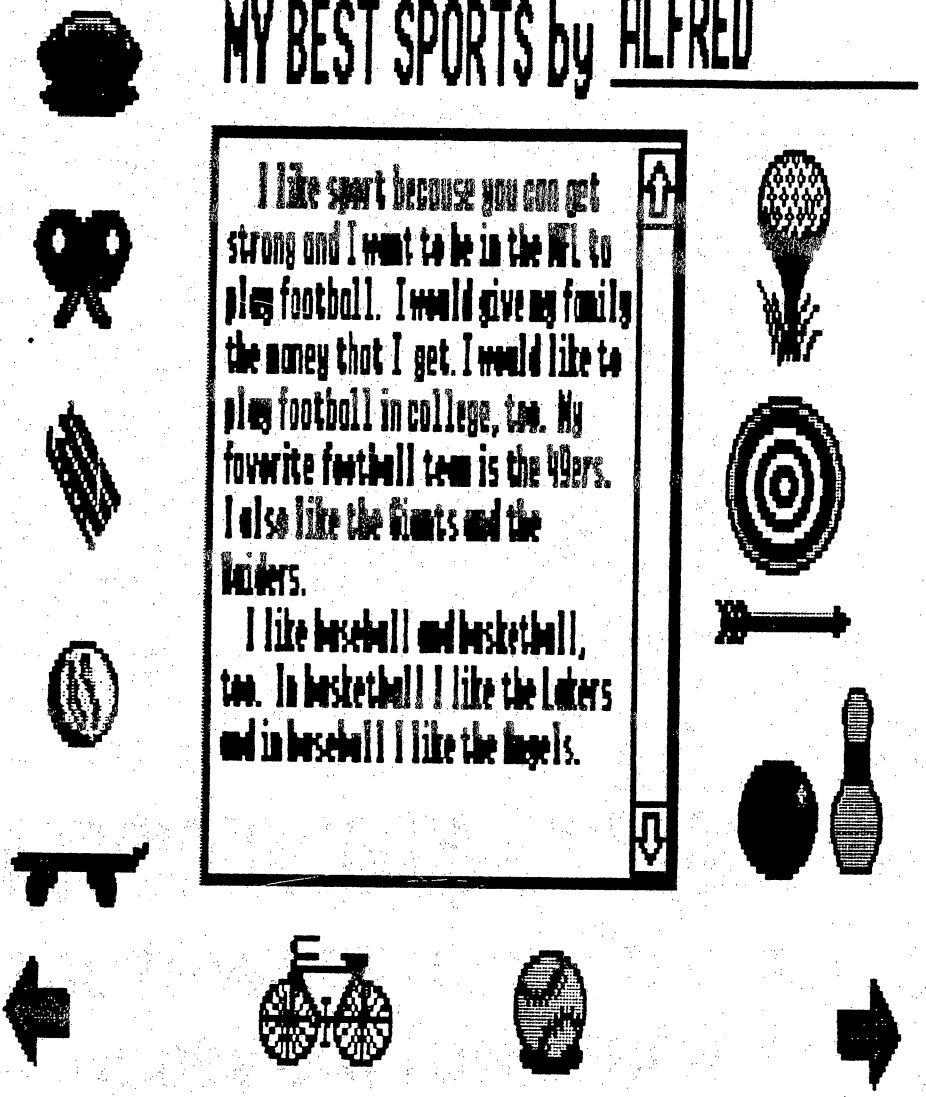
WORLD MAP

USA MAP





MY BEST SPORTS by ALFRED



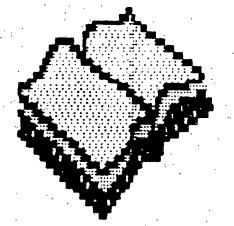
I like sport because you can get strong and I want to be in the NFL to play football. I would give my family the money that I get. I would like to play football in college, too. My fovvrite fvotball team is the 49ers. I also like the Giants and the Raiders.

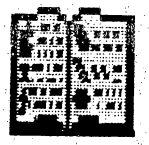
I like baseball and basketball, too. In basketball I like the Lakers and in baseball I like the Angels.

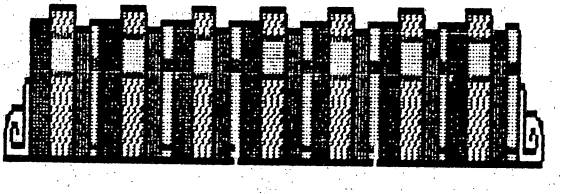
MY FAVORITE BOOKS BY DAWN

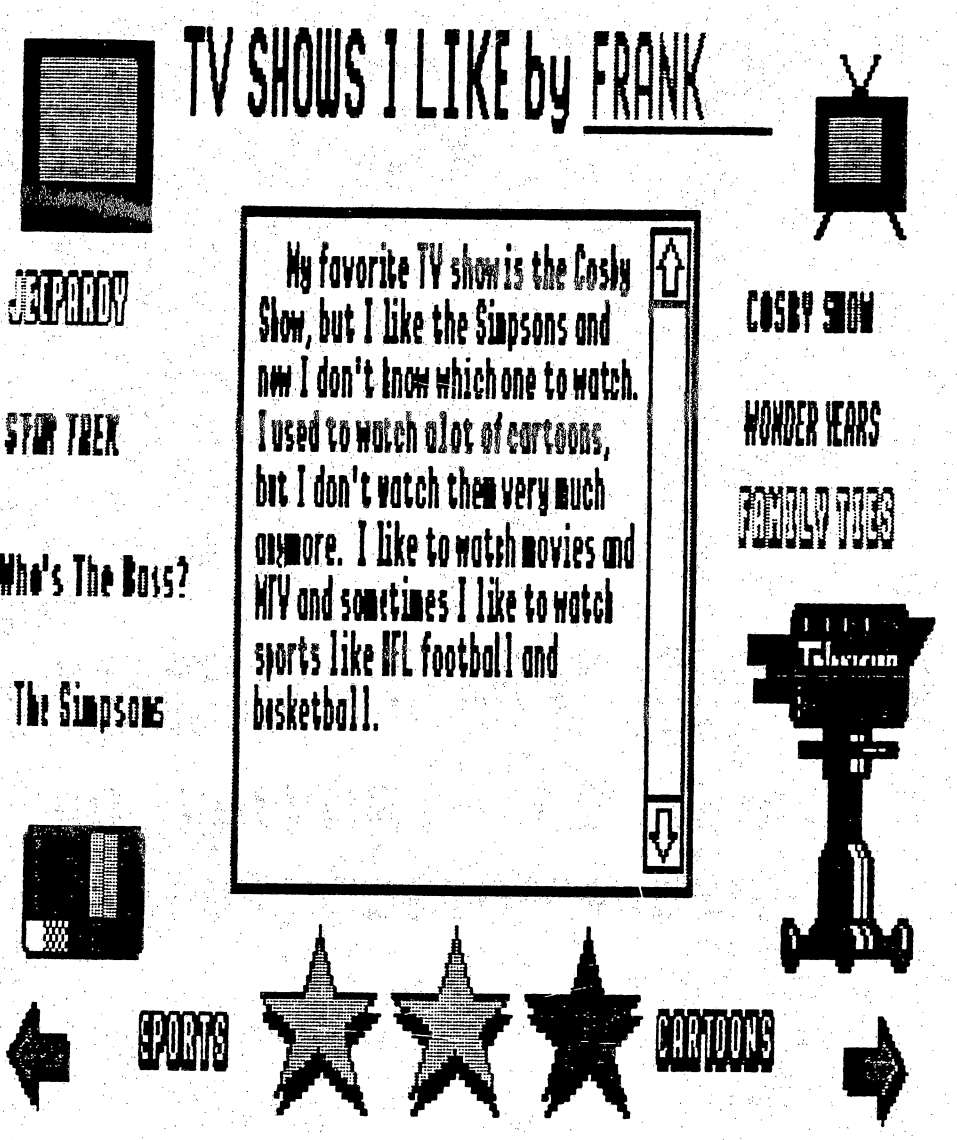
My favorite book is CHARLOTTE'S WEB. I like it because it's funny and sad. Another book I like is LASSIE COME HOME. I didn't read it, but my teacher read it to me. I like books about animals.

I like books that are funny, like Amelia Bedelia books. I also like to read funny poems like Where the Sidewalk Ends.







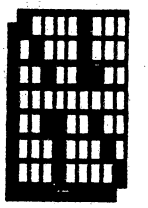

TV SHOWS I LIKE by FRANK
JEOPARDY
STAR TREK
Who's The Boss?
The Simpsons
My favorite TV show is the Cosby Show, but I like the Simpsons and now I don't know which one to watch. I used to watch alot of cartoons, but I don't watch them very much anymore. I like to watch movies and MTV and sometimes I like to watch sports like NFL football and basketball.
COSBY SHOW
WONDER YEARS
FAMILY TIES
SPORTS
CARTOONS

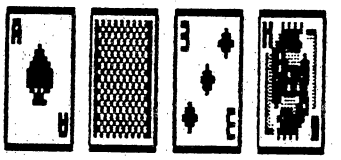
FAVORITE GAMES by LETICIA

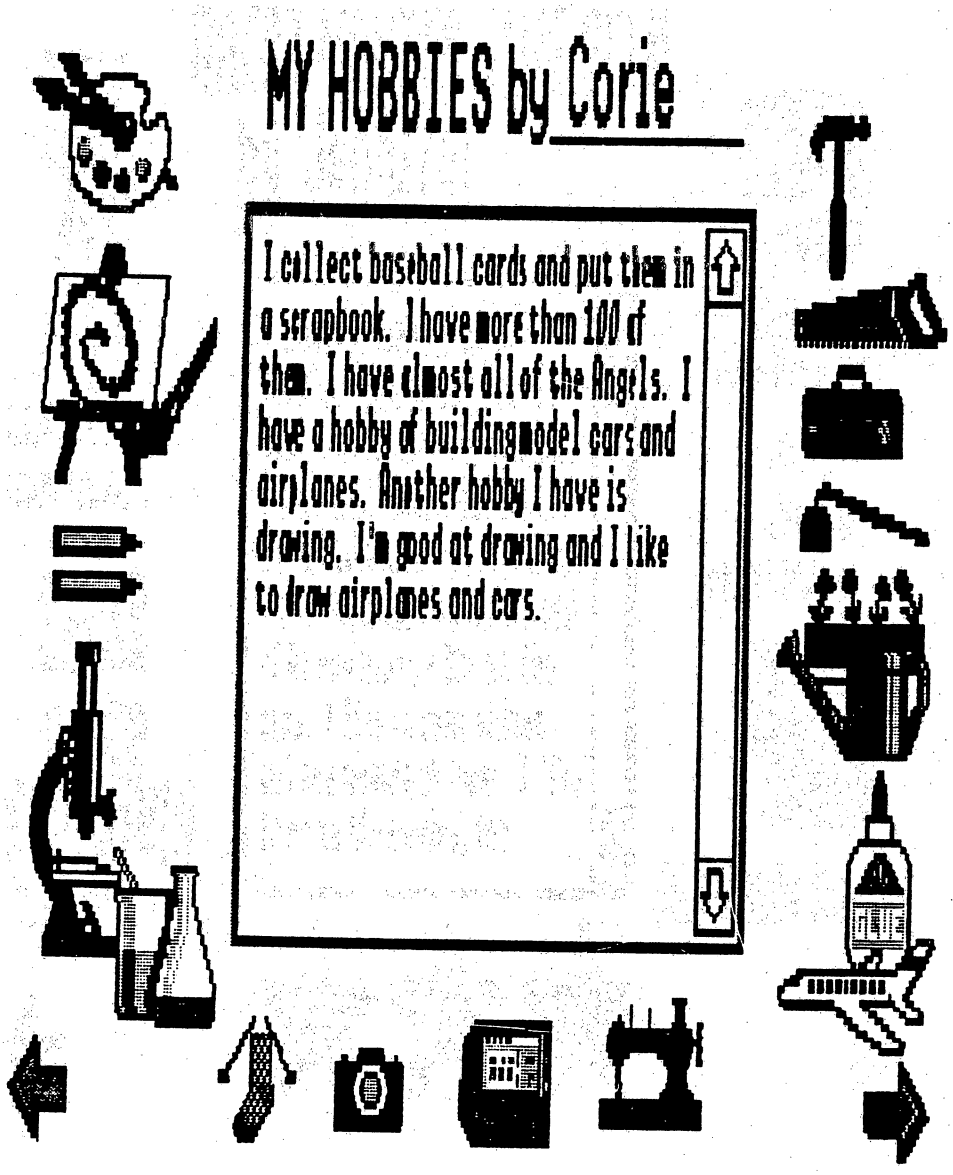
I like to play games. The game I like best is Monopoly. I also like to play checkers and Life.

I like to play Nintendo games. We have Mario brothers and it is fun. I like to play games on the computers at school. I like Word Attack and ZooStorm.

I like games like Hide and Seek and Dodge ball and jump rope and sometimes we play jacks.






MY HOBBIES by Corie
I collect baseball cards and put them in a scrapbook. I have more than 100 of them. I have almost all of the Angels. I have a hobby of building model cars and airplanes. Another hobby I have is drawing. I'm good at drawing and I like to draw airplanes and cars.


THE YUMMIEST FOOD BY CARLOS
My favorite food to eat is burritos. I like bean and cheese burritos best. I also like pizza with pepperoni.
My best dessert is pie. I like all kinds of pie, but apple is best. I like cake and cookies and ice cream and anything that is chocolate.
I hate vegetables like spinach, but corn is good.

REFERENCES

Bracey, G. (1988, October). Computers and learning: The research jury is still out. Electronic Learning, pp. 28, 30.

Bracey, G. (1991, February). Potential still not tapped. Electronic Learning. p. 12

Burns, P. C. & Roe, B. D. (1989). Burns/Roe informal reading inventory. Boston: Houghton Mifflin Co.

Corcoran, E. (1989, July). Show and tell. Scientific American, pp. 72-73.

Dede, C. J. (1990, January). Educators, take hold of the future. Electronic Learning, pp. 8-9.

D'Ignazio, F. (1990, December/January). Through the looking glass: The multiple layers of multimedia. The Computing Teacher, 17(4), 25-31.

Goodman, K. S., Goodman, Y. M., & Hood, W. J. (1989). The whole language evaluation book. Portsmouth: Heinemann.

Graves, D. H. (1983). Writing: Teachers and children at work. Portsmouth: Heinemann.

Howie, S. H. (1989). Reading, writing, and computers. Boston: Allyn & Bacon.

Jonassen, D. H. (1988, November). Designing structured hypertext and structuring access to hypertext. Educational Technology. 13-15.

Marcus, S. (1990, July/August). What are HyperCard? (sic) CUE Newsletter. pp. 13-15.

McCarthy, R. (June, 1989). Multimedia: What the excitement's all about. Electronic Learning. pp. 26-31.

Parsaye, K., Chigness, M., Khoshafian, S., & Wong, H. (1989). Intelligent databases: Object-oriented deductive hypermedia technologies. New York: John Wiley & Sons Inc.

Paske, R. (1990, August) .Hypermedia: A brief history and progress report. T.H.E. Journal, 18(1), 53-56.

Rhodes, L. K. & Dudley-Marling, C. (1988). Readers and writers with a difference. Portsmouth: Heinemann

Rickelman, R. J. & Henk, W. A. (1990, November). Reading and technology in the future. The Reading Teacher, 44(3), 262-263.

Robinson-Staveley, K. & Cooper, J. (1990). The use of computer for writing: Effects on an English composition class Journal of Educational Computing Research, 6(1), 41-47.

Rockman, S. (1989, Spring). Research on multimedia in schools: The time has come; the time is now. Apple Education News. (Available from Apple Computer, Cupertino, CA.)

Rogers, M. (1988, October 3) . Here comes hypermedia, Newsweek, pp. 44-45.

Vandergrift, K. E. (1988, November) . Hypermedia: Breaking the tyranny of the text, School Library Journal, 30-35.

SOFTWARE

O'Keefe, M., Kilmas, D., & Mueller, E. (1989). HyperStudio [Computer program]. El Cajon: Roger Wagner.